

Calendar No. 263

111<sup>TH</sup> CONGRESS  
2<sup>D</sup> SESSION

**H. R. 3276**

**[Report No. 111–120]**

IN THE SENATE OF THE UNITED STATES

NOVEMBER 6, 2009

Received; read twice and referred to the Committee on Energy and Natural  
Resources

JANUARY 28, 2010

Reported by Mr. BINGAMAN, with amendments

[Omit the part struck through and insert the part printed in *italie*]

## AN ACT

To promote the production of molybdenum-99 in the United States for medical isotope production, and to condition and phase out the export of highly enriched uranium for the production of medical isotopes.

1       *Be it enacted by the Senate and House of Representa-*  
2       *tives of the United States of America in Congress assembled,*

3       **SECTION 1. SHORT TITLE.**

4       This Act may be cited as the “American Medical Iso-  
5       topes Production Act of ~~2009~~2010”.

1 **SEC. 2. FINDINGS.**

2 Congress finds the following:

3 (1) Molybdenum-99 is a critical medical isotope  
4 whose decay product technecium-99m is used in ap-  
5 proximately two-thirds of all diagnostic medical iso-  
6 tope procedures in the United States, or 16 million  
7 medical procedures annually, including for the detec-  
8 tion of cancer, heart disease, and thyroid disease, in-  
9 vestigating the operation of the brain and kidney,  
10 imaging stress fractures, and tracking cancer stages.

11 (2) Molybdenum-99 has a half-life of 66 hours,  
12 and decays at a rate of approximately one percent  
13 per hour after production. As such, molybdenum-99  
14 cannot be stockpiled. Instead, molybdenum-99 pro-  
15 duction must be scheduled to meet the projected de-  
16 mand and any interruption of the supply chain from  
17 production, to processing, packaging, distribution,  
18 and use can disrupt patient care.

19 (3) There are no facilities within the United  
20 States that are dedicated to the production of mo-  
21 lybdenum-99 for medical uses. The United States  
22 must import molybdenum-99 from foreign produc-  
23 tion facilities, and is dependent upon the continued  
24 operation of these foreign facilities for millions of  
25 critical medical procedures annually.

1           (4) Most reactors in the world which produce  
2           molybdenum-99 utilize highly enriched uranium,  
3           which can also be used in the construction of nuclear  
4           weapons. In January 2009, the National Academy of  
5           Sciences encouraged molybdenum-99 producers to  
6           convert from highly enriched uranium to low en-  
7           riched uranium, and found that there are “no tech-  
8           nical reasons that adequate quantities cannot be  
9           produced from LEU targets in the future” and that  
10          “a 7-10 year phase-out period would likely allow  
11          enough time for all current HEU-based producers to  
12          convert”.

13          (5) The 51-year-old National Research Uni-  
14          versal reactor in Canada, which is responsible for  
15          producing approximately sixty percent of United  
16          States demand for molybdenum-99 under normal  
17          conditions, was shut down unexpectedly May 14,  
18          2009, after the discovery of a leak of radioactive  
19          water. It is unclear whether the National Research  
20          Universal reactor will be able to resume production  
21          of molybdenum-99.

22          (6) The United States currently faces an acute  
23          shortage of molybdenum-99 and its decay product  
24          technetium-99m due to technical problems which

1 have seriously interrupted operations of foreign nu-  
2 clear reactors producing molybdenum-99.

3 (7) As a result of the critical shortage of molyb-  
4 denum-99, patient care in the United States is suf-  
5 fering. Medical procedures requiring technetium-99  
6 are being rationed or delayed, and alternative treat-  
7 ments which are less effective, more costly, and may  
8 result in increased radiation doses to patients are  
9 being substituted in lieu of technetium-99.

10 (8) The radioactive isotope molybdenum-99 and  
11 its decay product technetium-99m are critical to the  
12 health care of Americans, and the continued avail-  
13 ability of these isotopes, in a reliable and affordable  
14 manner, is in the interest of the United States.

15 (9) The United States should move expedi-  
16 tiously to ensure that an adequate and reliable sup-  
17 ply of molybdenum-99 can be produced in the  
18 United States, without the use of highly enriched  
19 uranium.

20 (10) Other important medical isotopes, includ-  
21 ing iodine-131 and xenon-133, can be produced as  
22 byproducts of the molybdenum-99 fission production  
23 process. In January 2009, the National Academy of  
24 Sciences concluded that these important medical iso-  
25 topes “will be sufficiently available if Mo-99 is avail-

1       able''. The coproduction of medically useful isotopes  
2       such as iodine-131 and xenon-133 is an important  
3       benefit of establishing molybdenum-99 production in  
4       the United States without the use of highly enriched  
5       uranium, and these coproduced isotopes should also  
6       be available for necessary medical uses.

7               (11) The United States should accelerate its ef-  
8       forts to convert nuclear reactors worldwide away  
9       from the use of highly enriched uranium, which can  
10      be used in nuclear weapons, to low enriched ura-  
11      nium. Converting nuclear reactors away from the  
12      use of highly enriched uranium is a critically impor-  
13      tant element of United States efforts to prevent nu-  
14      clear terrorism, and supports the goal announced in  
15      Prague by President Barack Obama on April 5,  
16      2009, to create "a new international effort to secure  
17      all vulnerable nuclear material around the world  
18      within four years''.

19              (12) The United States is engaged in an effort  
20      to convert civilian nuclear test and research reactors  
21      from highly enriched uranium fuel to low enriched  
22      uranium fuel through the Global Threat Reduction  
23      Initiative. As of September 2009, this program has  
24      successfully converted 17 reactors in the United  
25      States to low enriched uranium fuel, some of which

1       are capable of producing molybdenum-99 for medical  
 2       uses.

3   **SEC. 3.2. IMPROVING THE RELIABILITY OF DOMESTIC MED-**  
 4       **ICAL ISOTOPE SUPPLY.**

5       (a) MEDICAL ISOTOPE DEVELOPMENT PROJECTS.—

6           (1) IN GENERAL.—The Secretary of Energy  
 7       shall establish a program to evaluate and support  
 8       projects for the production in the United States,  
 9       without the use of highly enriched uranium, of sig-  
 10      nificant quantities of molybdenum-99 for medical  
 11      uses: *shall establish a technology-neutral program—*

12           (A) *to evaluate and support projects for the*  
 13           *production in the United States, without the use*  
 14           *of highly enriched uranium, of significant quan-*  
 15           *tities of molybdenum-99 for medical uses;*

16           (B) *to be carried out in cooperation with*  
 17           *non-Federal entities; and*

18           (C) *the costs of which shall be shared in ac-*  
 19           *cordance with section 988 of the Energy Policy*  
 20           *Act of 2005 (42 U.S.C. 16352).*

21       (2) CRITERIA.—Projects shall be judged against  
 22       the following primary criteria:

23           (A) The length of time necessary for the  
 24       proposed project to begin production of molyb-

1           denum-99 for medical uses within the United  
2           States.

3           (B) The capability of the proposed project  
4           to produce a significant percentage of United  
5           States demand for molybdenum-99 for medical  
6           uses.

7           (C) The cost of the proposed project.

8           (3) EXEMPTION.—An existing reactor fueled  
9           with highly enriched uranium shall not be disquali-  
10          fied from the program if the Secretary of Energy de-  
11          termines that—

12           (A) there is no alternative nuclear reactor  
13           fuel, enriched in the isotope U-235 to less than  
14           20 percent, that can be used in that reactor;

15           (B) the reactor operator has provided as-  
16           surances that, whenever an alternative nuclear  
17           reactor fuel, enriched in the isotope U-235 to  
18           less than 20 percent, can be used in that reac-  
19           tor, it will use that alternative in lieu of highly  
20           enriched uranium; and

21           (C) the reactor operator has provided a  
22           current report on the status of its efforts to  
23           convert the reactor to an alternative nuclear re-  
24           actor fuel enriched in the isotope U-235 to less

1           than 20 percent, and an anticipated schedule  
2           for completion of conversion.

3           (4) *PUBLIC PARTICIPATION AND REVIEW.*—*The*  
4           *Secretary of Energy shall—*

5                     (A) *develop a program plan and annually*  
6                     *update the program plan through public work-*  
7                     *shops; and*

8                     (B) *use the Nuclear Science Advisory Com-*  
9                     *mittee to conduct annual reviews of the progress*  
10                    *made in achieving the program goals.*

11           ~~(4)~~(5) *AUTHORIZATION OF APPROPRIATIONS.*—

12           There are authorized to be appropriated to the Sec-  
13           retary of Energy for carrying out the program under  
14           paragraph (1) \$163,000,000 for the period encom-  
15           passing fiscal years 2010 through 2014.

16           (b) *DEVELOPMENT ASSISTANCE.*—The Secretary of  
17           Energy shall establish a program to provide assistance  
18           for—

19                     (1) the development of fuels, targets, and proc-  
20                     esses for domestic molybdenum-99 production that  
21                     do not use highly enriched uranium; and

22                     (2) commercial operations using the fuels, tar-  
23                     gets, and processes described in paragraph (1).

24           (c) *URANIUM LEASE AND TAKE BACK.*—The Sec-  
25           retary of Energy shall establish a program to make low



1 enriched uranium available, through lease contracts, for  
 2 irradiation for the production of molybdenum-99 for med-  
 3 ical uses. The lease contracts shall provide for the Sec-  
 4 retary to retain responsibility for the final disposition of  
 5 radioactive waste created by the irradiation, processing,  
 6 or purification of leased uranium. The lease contracts  
 7 shall also provide for compensation in cash amounts equiv-  
 8 alent to prevailing market rates for the sale of comparable  
 9 uranium products and for compensation in cash amounts  
 10 equivalent to the net present value of the cost to the Fed-  
 11 eral Government for the final disposition of such radio-  
 12 active waste, provided that the discount rate used to deter-  
 13 mine the net present value of such costs shall be no great-  
 14 er than the average interest rate on marketable Treasury  
 15 securities. The Secretary shall not barter or otherwise sell  
 16 or transfer uranium in any form in exchange for services  
 17 related to final disposition of the radioactive waste from  
 18 such leased uranium.

19 **SEC. 4.3. EXPORTS.**

20 Section 134 of the Atomic Energy Act of 1954 (42  
 21 U.S.C. ~~2160d(b)~~2160d) is amended by striking subsections  
 22 b. and c. and inserting in lieu thereof the following:

23 “b. Effective 7 years after the date of enactment of  
 24 the American Medical Isotopes Production Act of  
 25 ~~2009~~2010, the Commission may not issue a license for the

1 export of highly enriched uranium from the United States  
2 for the purposes of medical isotope production.

3 “c. The period referred to in subsection b. may be  
4 extended for no more than ~~four~~ 6 years if, no earlier than  
5 6 years after the date of enactment of the American Med-  
6 ical Isotopes Production Act of ~~2009~~2010, the Secretary  
7 of Energy certifies to the Committee on Energy and Com-  
8 merce of the House of Representatives and the Committee  
9 on Energy and Natural Resources of the Senate that—

10 “(1) there is insufficient global supply of molyb-  
11 denum-99 produced without the use of highly en-  
12 riched uranium available to satisfy the domestic  
13 United States market; and

14 “(2) the export of United States-origin highly  
15 enriched uranium for the purposes of medical iso-  
16 tope production is the most effective temporary  
17 means to increase the supply of molybdenum-99 to  
18 the domestic United States market.

19 “d. *To ensure public review and comment, the develop-*  
20 *ment of the certification described in subsection c. shall be*  
21 *carried out through announcement in the Federal Register.*

22 “~~d.e.~~ At any time after the restriction of export li-  
23 censes provided for in subsection b. becomes effective, if  
24 there is a critical shortage in the supply of molybdenum-  
25 99 available to satisfy the domestic United States medical

1 isotope needs, the restriction of export licenses may be  
2 suspended for a period of no more than 12 months, if—

3 “(1) the Secretary of Energy certifies to the  
4 Congress that the export of United States-origin  
5 highly enriched uranium for the purposes of medical  
6 isotope production is the only effective temporary  
7 means to increase the supply of molybdenum-99 nec-  
8 essary to meet United States medical isotope needs  
9 during that period; and

10 “(2) the Congress ~~passes~~*enacts* a Joint Resolu-  
11 tion approving the temporary suspension of the re-  
12 striction of export licenses.

13 “~~e.f.~~ As used in this section—

14 “(1) the term ‘alternative nuclear reactor fuel  
15 or target’ means a nuclear reactor fuel or target  
16 which is enriched to less than 20 percent in the iso-  
17 tope U-235;

18 “(2) the term ‘highly enriched uranium’ means  
19 uranium enriched to 20 percent or more in the iso-  
20 tope U-235;

21 “(3) a fuel or target ‘can be used’ in a nuclear  
22 research or test reactor if—

23 “(A) the fuel or target has been qualified  
24 by the Reduced Enrichment Research and Test

1           Reactor Program of the Department of Energy;  
2           and

3           “(B) use of the fuel or target will permit  
4           the large majority of ongoing and planned ex-  
5           periments and isotope production to be con-  
6           ducted in the reactor without a large percentage  
7           increase in the total cost of operating the reac-  
8           tor; and

9           “(4) the term ‘medical isotope’ includes molyb-  
10          denum-99, iodine-131, xenon-133, and other radio-  
11          active materials used to produce a radiopharma-  
12          ceutical for diagnostic, therapeutic procedures or for  
13          research and development.”.

14   **SEC. 5.4. REPORT ON DISPOSITION OF EXPORTS.**

15          Not later than 1 year after the date of the enactment  
16   of this Act, the Chairman of the Nuclear Regulatory Com-  
17   mission, after consulting with other relevant agencies,  
18   shall submit to the Congress a report detailing the current  
19   disposition of previous United States exports of highly en-  
20   riched uranium, including—

- 21           (1) their location;  
22           (2) whether they are irradiated;  
23           (3) whether they have been used for the pur-  
24   pose stated in their export license;

1           (4) whether they have been used for an alter-  
2       native purpose and, if so, whether such alternative  
3       purpose has been explicitly approved by the Commis-  
4       sion;

5           (5) the year of export, and reimportation, if ap-  
6       plicable;

7           (6) their current physical and chemical forms;  
8       and

9           (7) whether they are being stored in a manner  
10      which adequately protects against theft and unau-  
11      thorized access.

12 **SEC. 6.5. DOMESTIC MEDICAL ISOTOPE PRODUCTION.**

13       (a) IN GENERAL.—Chapter 10 of the Atomic Energy  
14      Act of 1954 (42 U.S.C. 2131 et seq.) is amended by add-  
15      ing at the end the following new section:

16       “SEC. 112. DOMESTIC MEDICAL ISOTOPE PRODUC-  
17      TION. a. The Commission may issue a license, or grant  
18      an amendment to an existing license, for the use in the  
19      United States of highly enriched uranium as a target for  
20      medical isotope production in a nuclear reactor, only if,  
21      in addition to any other requirement of this Act—

22           “(1) the Commission determines that—

23                   “(A) there is no alternative medical isotope  
24           production target, enriched in the isotope U-

1           235 to less than 20 percent, that can be used  
2           in that reactor; and

3           “(B) the proposed recipient of the medical  
4           isotope production target has provided assur-  
5           ances that, whenever an alternative medical iso-  
6           tope production target can be used in that reac-  
7           tor, it will use that alternative in lieu of highly  
8           enriched uranium; and

9           “(2) the Secretary of Energy has certified that  
10          the United States Government is actively supporting  
11          the development of an alternative medical isotope  
12          production target that can be used in that reactor.

13          “b. As used in this section—

14               “(1) the term ‘alternative medical isotope pro-  
15               duction target’ means a nuclear reactor target which  
16               is enriched to less than 20 percent of the isotope U-  
17               235;

18               “(2) a target ‘can be used’ in a nuclear re-  
19               search or test reactor if—

20                       “(A) the target has been qualified by the  
21                       Reduced Enrichment Research and Test Reac-  
22                       tor Program of the Department of Energy; and

23                       “(B) use of the target will permit the large  
24                       majority of ongoing and planned experiments  
25                       and isotope production to be conducted in the

1 reactor without a large percentage increase in  
 2 the total cost of operating the reactor;

3 “(3) the term ‘highly enriched uranium’ means  
 4 uranium enriched to 20 percent or more in the iso-  
 5 tope U-235; and

6 “(4) the term ‘medical isotope’ includes molyb-  
 7 denum-99, iodine-131, xenon-133, and other radio-  
 8 active materials used to produce a radiopharma-  
 9 ceutical for diagnostic, therapeutic procedures or for  
 10 research and development.”.

11 (b) TABLE OF CONTENTS.—The table of contents for  
 12 the Atomic Energy Act of 1954 is amended by inserting  
 13 the following new item ~~after the item relating to section~~  
 14 ~~111:~~ *at the end of the items relating to chapter 10 of title*  
 15 *I:*

“Sec. 112. Domestic medical isotope production.”.

16 **SEC. 7.6. ANNUAL DEPARTMENT OF ENERGY REPORTS.**

17 The Secretary of Energy shall report to Congress no  
 18 later than one year after the date of enactment of this  
 19 Act, and annually thereafter for 5 years, on Department  
 20 of Energy actions to support the production in the United  
 21 States, without the use of highly enriched uranium, of mo-  
 22 lybdenum-99 for medical uses. These reports shall include  
 23 the following:

24 (1) For medical isotope development projects—

1 (A) the names of any recipients of Depart-  
 2 ment of Energy support under ~~section 3~~ *section*  
 3 *2* of this Act;

4 (B) the amount of Department of Energy  
 5 funding committed to each project;

6 (C) the milestones expected to be reached  
 7 for each project during the year for which sup-  
 8 port is provided;

9 (D) how each project is expected to sup-  
 10 port the increased production of molybdenum-  
 11 99 for medical uses;

12 (E) the findings of the evaluation of  
 13 projects under ~~section 3(a)(2)~~ *2(a)(2)* of this  
 14 Act; and

15 (F) the ultimate use of any Department of  
 16 Energy funds used to support projects under  
 17 ~~section 3~~ *section 2* of this Act.

18 (2) A description of actions taken in the pre-  
 19 vious year by the Secretary of Energy to ensure the  
 20 safe disposition of radioactive waste from used mo-  
 21 lybdenum-99 targets.

22 **SEC. 8.7. NATIONAL ACADEMY OF SCIENCES REPORT.**

23 The Secretary of Energy shall enter into an arrange-  
 24 ment with the National Academy of Sciences to conduct  
 25 a study of the state of molybdenum-99 production and uti-



1 lization, to be provided to the Congress not later than 5  
 2 years after the date of enactment of this Act. This report  
 3 shall include the following:

4 (1) For molybdenum-99 production—

5 (A) a list of all facilities in the world pro-  
 6 ducing molybdenum-99 for medical uses, includ-  
 7 ing an indication of whether these facilities use  
 8 highly enriched uranium in any way;

9 (B) a review of international production of  
 10 molybdenum-99 over the previous 5 years, in-  
 11 cluding—

12 (i) whether any new production was  
 13 brought online;

14 (ii) whether any facilities halted pro-  
 15 duction unexpectedly; and

16 (iii) whether any facilities used for  
 17 production were decommissioned or other-  
 18 wise permanently removed from service;  
 19 and

20 (C) an assessment of progress made in the  
 21 previous 5 years toward establishing domestic  
 22 production of molybdenum-99 for medical uses,  
 23 including the extent to which other medical iso-  
 24 topes ~~coproduced~~ *that have been produced* with

1           molybdenum-99, such as iodine-131 and xenon-  
2           133, are being used for medical purposes.

3           (2) An assessment of the progress made by the  
4       Department of Energy and others to eliminate all  
5       worldwide use of highly enriched uranium in reactor  
6       fuel, reactor targets, and medical isotope production  
7       facilities.

8   **SEC. 9.8. DEFINITIONS.**

9       In this Act the following definitions apply:

10           (1) **HIGHLY ENRICHED URANIUM.**—The term  
11       “highly enriched uranium” means uranium enriched  
12       to 20 percent or greater in the isotope U-235.

13           (2) **LOW ENRICHED URANIUM.**—The term “low  
14       enriched uranium” means uranium enriched to less  
15       than 20 percent in the isotope U-235.



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11<sup>TH</sup> CONGRESS  
2<sup>D</sup> Session

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JANUARY 28, 2010

Reported with amendments